

# Stand-Alone Power Systems for Rural Health Facilities

by Tony Jimenez 11/99

## Background

It is estimated that two billion people currently live in areas that lack electricity. Many of these areas will not be connected to the electric grid in the foreseeable future due to high grid-extension costs. However, areas beyond the grid can be serviced by a variety of stand-alone systems. These stand-alone systems can consist of combinations of photovoltaic (PV) panels, wind turbines, and generators running on diesel, gasoline, or propane. Stand-alone systems range in size from small solar lighting systems that provide 100–200 watt-hours for lighting at night, to diesel-powered minigrids with peak capacities of more than a megawatt.

In remote communities, the local health clinic is often the first facility to be provided with electricity. Traditionally, the power has been supplied with fossil-fuel generators. More recently, PV panels have been installed in some clinics to provide electricity. Wind turbine generators have received less consideration for providing electricity to clinics.

## Typical Clinic Services

- Inoculations
- Treatments for: Respiratory infections
  - Venereal diseases
  - Diarrheal diseases
  - Skin disease
  - Eye disease
  - Malaria
  - Parasitical diseases
- Trauma:
  - Burns
  - Simple fractures
  - Wounds
  - Snake bites
- Prenatal/postnatal care and child birth
- Dental

- Referral to hospitals
- Public health education
- Family planning

## Typical Applications

Typically, health clinics require electricity for lighting, communication equipment, and refrigeration. Electric lighting is vastly superior to candles and kerosene lamps. Often, when a clinic is electrified, lights are included in the initial installation package. Because of the need to conserve power, most off-grid clinics use compact fluorescent lights that typically draw from 5 to 20 watts each. Even clinics that use day-lighting need electric lights for emergency night care. Emergencies also require reliable communication equipment. Electricity provides radio and satellite communications that enable the clinic staff to consult with specialists as needed and to arrange for the speedy evacuation of seriously ill or injured patients.

Health clinics also rely heavily on refrigeration to maintain the viability of medicines and vaccines. In the last 15 years, great progress has been made in the development of vaccine refrigerators. These small, highly efficient, usually DC, refrigerators can be powered by a modest-sized solar array. Typical models draw 80–120 watts and will run for around 10 hours per day. Some super-efficient models use even less energy. Although they are expensive, these refrigerators are becoming increasingly popular and are considered so important that the World Health Organization has set standards for them. Like lighting, a vaccine refrigerator is often included in the installation package when a clinic is initially electrified.

Other applications for electric power in clinics include small water pumps, ceiling fans, small sterilizing stoves, vaporizers, computers, centrifuges, and TVs and VCRs. The latter are used

not only for entertainment, but also to show instructional and public health videos. Larger facilities such as district hospitals also may have additional laboratory equipment.

### Typical Electrical Appliance Data

Item	Power (Watts)	Duty Cycle (hours/day)	Energy Use (kWh/day)
Lights	5-20	Varies	Varies
2-way radio	75	1	0.075
Refrigerator	60-120		0.3-0.7
Stove	200-500	1	0.2-0.5
Vaporizer	35-70	1	0.035-0.070
Ceiling fan	5-20	Varies	Varies

In collaboration with Solar Energy International, the National Renewable Energy Laboratory's (NREL's) Village Power group has published "Renewable Energy for Rural Health Clinics," which describes the use of renewable energy to provide electricity to remote health clinics. The publication describes common health clinic applications and stand-alone energy-system architectures, gives guidance on describing the lowest-cost systems, and lists considerations that need to be addressed by project planners to ensure successful programs. The guide is available in English and Spanish. Both versions of the guide can be downloaded from the RSVP Web site

(see contact information). This guide is the first of a series that will be published by the Village Power group. Guides currently in progress cover school electrification, microenterprise, and water pumping.

### Health Clinic Replication

In addition to publishing the guide, the Village Power team is building a replica of a health clinic at NREL's National Wind Technology Center. This clinic will demonstrate various health-clinic-related applications including lighting, medical appliances, water pumping, and water purification.

### NREL Contact

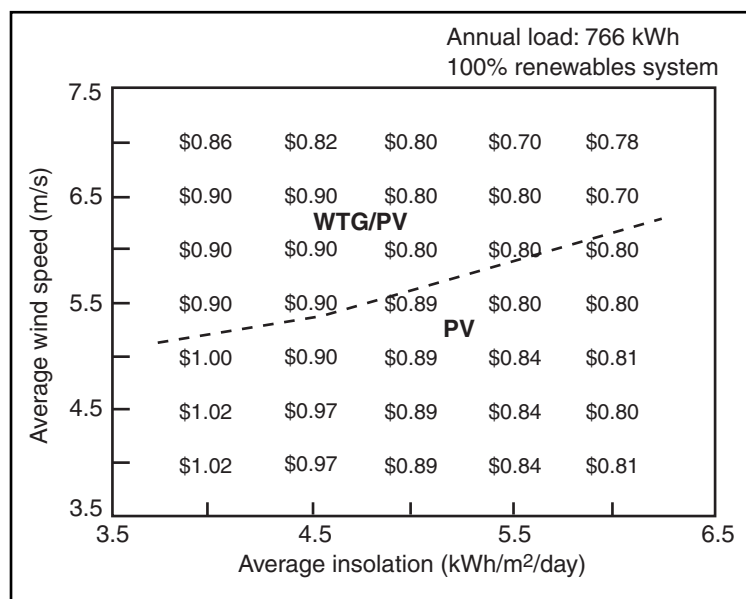
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Produced by the National Renewable Energy Laboratory, a U.S. Department of Energy national laboratory.

Printed with renewable-source ink on paper containing at least 50% wastepaper, including 20% postconsumer waste.

NREL/FS-500-24196



Health clinic cost of energy (\$/kWh).